ARTIFACT SHEET

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CLAIMS:

1. A mass spectrometer system comprising:

a pulsed ion source, for providing pulses of analyte ions;

a mass spectrometer;

an ion path extending between the ion source and the mass spectrometer; and

an ion transmission device located in said ion path and having a damping gas in at least a portion of the ion path, whereby there is effected at least one of: a reduction in the energy spread of ions emitted from said ion source; conversion of pulses of ions from the ion source into a quasi-continuous beam of ions; at least partial suppression of unwanted fragmentation of analyte ions; and spreading ions spatially and temporally along the ion path, whereby peak current and space charge effects are reduced.

2. A mass spectrometer system as claimed in claim 1, wherein the damping gas has a pressure in the range of from about 10^{-4} Torr up to at least 760 Torr.

3. A mass spectrometer system as claimed in claim 2, wherein the damping gas is provided adjacent the pulsed ion source and has a pressure sufficient to effect reduction of the energy spread of ions emitted from said ion source.

4. A mass spectrometer system as claimed in claim 2, wherein the ion path includes a multipole rod set and the damping gas is provided in the multipole rod set, and wherein the product of the pressure of the damping gas within the multipole rod set times the length of the rods of the multipole

rod set is at least 10.0 mTorr-cm.

5. A mass spectrometer system as claimed in claim 2, which includes at least one of a multipole rod set and a ring set, with the ion path extending through and the damping gas being provided in each of the multipole rod set and the ring set, when present.

6. A mass spectrometer system as claimed in any one of claims 1 to 5, wherein the mass spectrometer comprises a time of flight mass spectrometer.

7. A mass spectrometer system as claimed in claim 6, wherein the time of flight mass spectrometer comprises an orthogonal time of flight mass spectrometer whereby the quasi-continuous beam of ions enters the orthogonal time of flight mass spectrometer and is pulsed, to convert the quasi-continuous beam of ions back into pulses of ions.

8. A mass spectrometer system as claimed in any one of claims 1 to 5, wherein the mass spectrometer comprises one of a quadrupole spectrometer, an ion trap spectrometer, a magnetic sector spectrometer and a Fourier transform mass spectrometer.

9. A mass spectrometer system as claimed in claim 3, which includes a first differential pressure chamber, with the pulsed ion source being provided in the first differential pressure chamber.

10. A mass spectrometer system as claimed in claim 3, which includes a first differential pressure chamber, with the pulsed ion source being provided in a first differential pressure chamber, a second differential

pressure chamber located between the first differential pressure chamber and the mass spectrometer, and a skimmer between the first and second differential pressure chambers for maintaining a pressure differential between the first and second differential pressure chambers.

11. A mass spectrometer system as claimed in claim 9, wherein the first differential pressure chamber includes a multipole rod set configured to act as an ion guide.

12. A mass spectrometer system as claimed in claim 10, wherein the second differential pressure chamber includes a multipole rod set configured to act as an ion guide.

13. A mass spectrometer system as claimed in claim 5, 11 or 12, which includes a mass analyzer and a collision cell, provided before the mass spectrometer and in the ion path, the mass analyzer including a multipole rod set configured to select a precursor ion, and the collision cell being provided with a damping gas in use, for causing fragmentation of selected precursor ions, to form fragment ions for analysis in the mass spectrometer.

14. A mass spectrometer system as claimed in claim 13, wherein the collision cell is provided in a separate chamber from the mass analyzer.

15. A mass spectrometer system as claimed in claim 13, wherein the mass spectrometer comprises an orthogonal time of flight mass spectrometer.

16. A mass spectrometer system as claimed in claim 13, wherein the mass spectrometer comprises a quadrupole mass filter.

17. A mass spectrometer system as claimed in claim 2, 3 or 7, wherein the pulsed ion source comprises a surface containing analyte molecules and a pulsed laser directed at the surface, for providing laser pulses to cause ionization of the analyte molecules.

18. A mass spectrometer system as claimed in claim 17, wherein said surface contains a target material composed of a matrix and analyte molecules in the matrix, the matrix comprising a species which absorbs radiation from the pulsed laser, to promote desorption and ionization of the analyte molecules.

19. A mass spectrometer system as claimed in any preceding claim, which additionally includes a continuous ion source and means for selecting one of the continuous ion source and the pulsed ion source.

20. A mass spectrometer system as claimed in claim 19, which includes at least one of: a plurality of pulsed ion sources; and a plurality of continuous ion sources, wherein the means for selecting enables selection of any of the continuous and pulsed ion sources.

21. A mass spectrometer system as claimed in claim 1, which includes selection means for effecting mass selection of a precursor ion and collision induced dissociation of precursor ions to form fragment ions, said selection means being located in the ion path before the mass spectrometer.

22. A mass spectrometer system as claimed in claim 21, wherein the selection means comprises an ion trap for effecting both mass selection of a precursor ion and collision induced dissociation.

23. A mass spectrometer system as claimed in claim 21, wherein collision induced dissociation is effected by one of ultraviolet or infrared radiation or by surface induced dissociation.

24. A method of generating ions and delivering ions to a mass spectrometer, the method comprising the steps of:

(1) providing an ion source;

(2) causing the ion source to produce pulses of ions;

(3) providing an ion transmission device along an ion path extending from the ion source and providing the ion transmission device with a damping gas in at least a portion of the ion path, to effect at least one of: a reduction in the energy spread of ions emitted from said ion source; conversion of pulses of ions from the ion source into a quasi-continuous beam of ions; and at least partial suppression of unwanted fragmentation of analyte ions; and

(4) passing ions from the ion transmission device into the mass spectrometer for mass analysis.

25. A method as claimed in claim 24, wherein the gas is provided a pressure in a range of from approximately 10^{-4} Torr up to at least 760 Torr.

26. A method as claimed in claim 24, which comprises providing damping gas adjacent the ion source, and having a pressure sufficient to effect a reduction in the energy spread of ions emitted from said ion source.

27. A method as claimed in claim 26, wherein the gas pressure is such that ions emitted from the ion source are sufficiently damped, to reduce substantially unwanted fragmentation of ions.

28. A method as claimed in claim 25, 26 or 27, which includes providing a multipole rod set along the ion path and providing a gas pressure such that the multiple of the length of the rods of the rod set times the gas pressure is at least 10.0 mTorr-cm.

29. A method as claimed in claim 25, which includes passing the ions along the ion path through at least one of a multipole rod set and a ring set.

30. A method as claimed in claim 24, 25, 26 or 27, which comprises mass analyzing the ions in step (4) with a time of flight mass spectrometer.

31. A method as claimed in claim 30, which comprises arranging the ion path orthogonally relative to the axis of the time of flight mass spectrometer, passing the quasi-continuous beam of ions substantially continuously into the time of flight mass spectrometer, and pulsing the ions in the time of flight mass spectrometer to effect mass analysis.

32. A method as claimed in any one of claims 24, 25, 26 or 27, which includes effecting mass analysis in step (4) in one of a quadrupole spectrometer, an ion trap spectrometer, a magnetic sector spectrometer and Fourier transform mass spectrometer.

33. A method as claimed in claim 26, which includes providing a differential pressure region extending from the ion source and including an ion guide comprising a multipole rod set, the method including maintaining a desired pressure in the differential pressure region, and operating the ion guide to collect and guide ions along the ion path.

34. A method as claimed in claim 33, which includes: providing a first differential pressure region immediately adjacent the ion source; providing the ion guide in a second differential pressure region adjacent the first differential pressure region and a skimmer separating the first and second differential pressure regions; causing ions generated by an ion source to travel along the ion path from the first differential pressure region to the second differential pressure region by at least one of gas flow and an electrostatic potential.

35. A method as claimed in claim 24, 25, 26, or 33, which includes providing a mass analyzer including a multipole rod set and a collision cell including a multipole rod set, the method including passing ions through the mass analyzer to select precursor ions, passing the precursor ions into the collision cell to cause collision induced dissociation, thereby forming fragment ions, and subsequently passing the fragment ions into the mass spectrometer for mass analysis.

36. A method as claimed in claim 35, which includes passing the ions from the collision cell orthogonally into a time of flight device, and pulsing ions in the time of flight device to effect mass analysis.

37. A method as claimed in claim 24, 25, 26 or 33, which includes generating ions by providing a source of analyte molecules and irradiating the source of analyte molecules with a pulsed laser beam, thereby generating pulses of ions.

38. A method as claimed in claim 37, which includes providing the analyte molecules in a target material comprising a matrix of a species adapted to absorb radiation from the laser and the analyte molecules, the

method comprising irradiating the matrix with the pulsed laser, whereby the species absorbs laser radiation to cause desorption and ionization of the analyte molecules.

39. A method as claimed in any one of claims 24 to 38, which includes providing a continuous ion source, and selecting one of the first-mentioned ion source, for pulsed ions, and the continuous ion source, to produce ions.

40. A method as claimed in 39, which includes providing at least one of: a plurality of pulsed ion sources; and a plurality of continuous ion sources, the method further comprising selecting any one of the continuous and pulsed ion sources for providing ions.

41. A method as claimed in claim 24, which includes prior to passing the ions into the mass spectrometer in step (4), selecting a precursor ion and effecting collision induced dissociation of the precursor ions to form fragment ions, and subsequently passing the fragment ions into the mass spectrometer for mass analysis.

42. A method as claimed in claim 41, which includes effecting mass selection of a precursor ion and collision induced dissociation in a single device.

43. A method as claimed in claim 40, which includes effecting collision induced dissociation by one of ultraviolet or infrared radiation or by surface induced dissociation.